FISHERIES OF LAKE TAHOE AND ITS TRIBUTARY WATERS

A Guide for Planning

Prepared for
Tahoe Regional Planning Agency
and
Forest Service, U. S. Department of Agriculture

South Lake Tahoe, California
May 1971

ACKNOWLEDGMENTS

Establishment of the Tahoe Regional Planning Agency was consented to by the Congress through enactment of Public Law 91-148. On March 19, 1970, the governors of Nevada and California signed the proclamation that proclaimed creation of the Tahoe Regional Planning Agency. Since the authorized staff of the Agency was small, it enlisted help from several committees composed of technical specialists and other citizens concerned with resource conservation and orderly development of the Tahoe environmental resources.

The planning effort has been aided greatly by generous cooperation from numerous federal, state, county, and municipal agencies and from several colleges and interested private individuals. Cooperating agencies included:

Federal:

Department of Agriculture: Forest Service; Soil Conservation Service

Department of Commerce: Environmental Science Services Administration

Department of Defense: Army Corps of Engineers

Department of Interior: The Bureaus of Mines, Outdoor Recreation, Reclamation, Sport Fisheries and Wildlife; Federal Water Quality Administration; and the Geological Survey

Department of Transportation: Coast Guard; Federal Highway Administration; Federal Aviation Administration

State:

California: The Resources Agency of California

Nevada: The Nevada Department of Conservation and Natural Resources

County and Municipal:

Carson City, Douglas, and Washoe Counties, Nevada; El Dorado and Placer Counties and City of South Lake Tahoe, California

Schools:

Foresta Institute; Sacramento State College, Tahoe College; University of California at Berkeley and Davis; University of Nevada; Desert Research Institute

Any publication that compiles and presents information from so large and disparate a group of contributors as this one does is susceptible to error, inconsistency, and omission. Sustained effort has been made to avoid these flaws; but if it has failed occasionally, the reader's forbearance is humbly solicited.

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INTRODUCTION

General Features of the Lake Tahoe Planning Area

Lake Tahoe and the mountainous timber-covered basin immediately surrounding it provide one of the most beautiful environments in the Sierra Nevada and in the nation. The Lake itself, an irregular oval about 22 miles long by 12 miles wide, covers 191 square miles; it occupies a deep depression between crests of the Sierra Nevada and Carson ranges. Since its surface is maintained at an average of 6,225 feet above mean sea level, Lake Tahoe is one of the largest high-altitude lakes in the world. The clarity and purity of its water are outstanding. In fact, protection of quality of the water in Lake Tahoe is a primary objective for effective control of the region's environment.

The spectacular scenery of the Lake Tahoe Region results from unique geological conditions that prevailed when the lake was formed. The basement rock is predominantly granite related to the rocks found throughout the Sierra Nevada. On the other hand, the geologic structure–the faulting that produced the lake basin itself–is related to the Basin Ranges that extend eastward from the Sierra to the Wasatch Range in Utah. The lake was formed by a natural dam–a great pile of andesitic mudflow breccia–across the north outlet.

Lake Tahoe is on the eastern boundary of that part of the Sierra Nevada that was extensively glaciated during the Pleistocene epoch.

Huge valley glaciers moved down canyons along the western side of the lake, scouring away loose rock and building up great piles of morainal debris. Along the eastern side, glaciers developed only on the shaded side of the highest peaks; so most of this area was not glaciated. This accounts for the subdued rolling topography typical of the Carson Range, as contrasted to the rugged Sierran crest on the west side of the basin.

Climate of the region is strongly influenced by topography. Marine air from the Pacific Ocean, 150 miles to the west, drops its moisture (mostly as snow) as it rises over the crest of the Sierra. Average annual precipitation ranges from more than 50 inches on the western side of the region to about 25 inches along much of the eastern shoreline. The Weather Bureau at Tahoe City, on the west side, reports long-term average snowfall of 213 inches. The fairly long summers are comparatively cool; mean maximum temperature at Tahoe City in July over a 50-year period was 78 degrees F. Winters are cold but seldom severe; mean daily minimum temperature for January over the same period was 17 degrees F. The high elevation and cool temperatures result in a short growing season--an average of only 70 to 120 frost-free days per year at various points near the Lake.

Vegetation includes desert, montane, and alpine species typical of the eastern slopes of the Sierra. Pine and fir forests were heavily logged betwen 1860 and 1900 when demand for lumber and props for the Nevada silver mines was high. Even so, today the region has good stands of conifers between the Lake level and 9,000 feet, plus considerable areas covered by chaparral and other brush. On fairly level open areas that have a few inches of soil, grasses and other herbage flourish during the short growing season.

Numerous species of wildlife inhabit the Lake Tahoe Region. Deer, bear, mountain lion, coyote,

rabbit, raccoon, and several rodents are common. Land birds and waterfowl are present in small numbers consistent with available habitat. Heavy commercial fishing in the Lake around 1900, plus other human activities, greatly depleted native populations of native fish, but kokanee salmon and several species of fish stocked from state hatcheries provide good recreational fishing today. Native cutthroat rainbow trout and whitefish are the best challenges to fishermen today, but they are not numerous.

Since the native cutthroat fishery collapsed in the early 1930's fishing in Lake Tahoe has had a poor reputation. The many tributary streams and high mountain lakes contribute to the fishing opportunities in the Region. Even though many other fishing areas are more productive than Lake Tahoe itself, the opportunity to fish here is a strong recreational attraction. However, recent accelerated man-caused disturbance is damaging valuable fish habitat in the streams and is reducing fish populations both in these streams and in Lake Tahoe.

Soils are generally shallow and highly erodible–easily disturbed and slow to stablilize– but the soil is fairly deep in some bottom lands and glacial debris areas. The varied climate and highly erodible soils combine to make the Lake Tahoe region a fragile environment. Hence the ecological balance is easily upset. Whenever vegetation is removed, it is not soon replaced. Erosion by wind and water is a constant hazard; it damages pristine features of the Lake, including the spawning areas of native fish.

Changing Environment

Before the white man invaded this area about the middle of the 1800's, the somewhat nomadic Washo Indian tribe inhabited it. Their name for the lake, "Tahoe," has been variously translated as "big water," "high water," or "water in a high place." The first recorded white visitors were John Fremont's exploring party (1844); they were soon followed by the Forty-niners and other western migrants and adventurers.

During most of the following 100 years, Lake Tahoe was the summer recreation area for wealthy Californians, mostly from San Francisco and the Sacramento Valley. The few summer resorts, scattered stores, service stations, and restaurants hardly marred the natural beauty of the region.

Soon after World War II all this began to change. With increased general affluence, steadily and rapidly increasing numbers of vacationers began to visit the area; their visits gradually extended the "season" from summer to the full year. Establishment of year-round casinos at Stateline in 1955 and the phenomenal growth of winter sports added to the influx of both visitors and residents. By unofficial count in 1965, the region had nearly 29,000 yearlong residents–more than double the 1960 federal census figure. Present projections anticipate more than 50,000 residents by 1980 and an added summer population topping 250,000.

These projected increases in resident and transient populations will inevitably multiply and intensify the environmental problems that already are plaguing the area. Hence the crucial need for planning orderly development that can be sustained by the natural capacities of the region.

Administrative and Governmental Responsibility

The Planning Area established by the Bi-State Planning Compact between the States of California and Nevada is a basin covering 332,160 acres plus 3,340 acres near the Lake outlet in the Lower Truckee River drainage. This includes the 122,628 acres of Lake surface. Governmental jurisdiction over land in the Lake Tahoe Planning Area is complex. The Area is divided between California (Placer, El Dorado, and Alpine counties) and Nevada (Washoe and Douglas counties and Carson City). This division of governmental responsibility makes it difficult to coordinate the administration of government in the Area in the interest of protecting the environment.

Nearly half (48.7 percent) of the land area is federally-owned–chiefly in three National Forests totaling 103,872 acres. An additional 4.5 percent is state owned, nearly all in State Parks. Thus about 53 percent of the land in the Planning Area is publicly owned.

Of nearly 75 miles of lake shoreline, about 18 percent is publicly owned. This is chiefly 8 miles belonging to the State of California and 5.5 miles in National Forests.

Tahoe Regional Planning Agency (TRPA)

The Tahoe Regional Planning Agency began work as soon as the governors of California and Nevada signed the proclamation creating the Bi-State Planning Agency. Public Law 91-148 had enumerated the dangers of deterioration of the natural environment at Tahoe and of the increasing demands on various natural resources and features of the Region; also, it emphatically stated the need to maintain equilibrium between the Region's natural endowment and limitations on one hand and the environment that man is creating. It recognized need for establishing "an area-wide planning agency with powers to adopt and enforce a regional plan of resource conservation and orderly development, to exercise effective environmental controls, and to perform other essential functions...."

TRPA was ordered to develop and adopt, with 18 months of its formation (i.e., by September 1971) a plan for regional development that would include separate plans for land use, transportation, conservation, recreational development, and public services and facilities, to name a few. The Agency was further directed to consider and to seek to harmonize the needs of the whole Region with the plans of local governmental units and the existing land use plans of State and Federal agencies.

Since nearly half of the land area in the Lake Tahoe Region is in National Forests, the Forest Service has major responsibility for improving environmental features here. In 1970 it established the Lake Tahoe Basin Planning Team to work with TRPA. Although the Agency and Team have separate organizations and responsibilities, they have cooperated closely to achieve a common goal.

In describing and analyzing the fisheries in the Tahoe Region, this publication shows some consequences to these fisheries resulting from some changing of the ecological balance. Most of the research data were compiled by the California and Nevada Departments of Fish and Game. It is hoped that the information presented herein will prove useful in regional planning for maintaining and enhancing this resource.

CHARACTERISTICS AND DISTRIBUTION OF FISH SPECIES

IN THE LAKE TAHOE REGION

Species of fish in the Lake Tahoe Region may be classified conveniently as game and nongame fish. The game fish are so called because they are more elusive than nongame fish and, when hooked, put up more fight to escape. The species of game fish in the Lake Tahoe Region and their distinguishing characteristics are set forth below. The game fish in this area are:

Brown trout	*Salmo trutta*
Eastern brook trout	*Salvelinus fontinalis*
Golden trout	*Salmo aguabonita*
Kamloops rainbow trout	*S. gairdneri kamloops*
Kokanee salmon	*Onchorhynchus nerka kennerlyi*
Lahontan cutthroat trout	*Salmo clarki henshawi*
Lake trout	*Salvelinus namaycush*
Mountain whitefish	*Prosopium williamsoni*
Rainbow trout	*Salmo gairdneri*

The rainbow trout are a self-sustaining population, probably descendants of steelhead rainbow trout (*Salmo gairdneri gairdneri*) and Shasta rainbow trout (*S. gairdneri stonei*). Kamloops rainbow trout were planted in recent years.

The species of game fish in the Lake Tahoe Region and their distinguishing characteristics are set forth below.

GAME FISH

Brown trout

The brown trout was probably introduced into the Tahoe Region early in the 1900's. They can tolerate warmer water temperatures than other trout and are ideally suited to lower elevation streams. Since they spawn in the fall, the other fish they may compete with for spawning habitat are kokanee salmon and eastern brook trout. In recent years a new strain of brown trout, called the Massachusetts, has been developed. It is somewhat less gamey than the regular brown trout and probably will be stocked generously in the future.

Eastern brook trout

Original range of the eastern brook trout was the northeastern portion of the North American continent from the Great Lakes states to the Atlantic Ocean. This species was introduced into the Tahoe Region in 1888. It is ideally suited to high mountain lakes and streams and is chiefly found there today. Brook trout spawn in the fall and, like the Lake trout, can spawn in standing waters.

Golden trout

The golden trout is a native Californian, but not in the Tahoe Region. It spawns from May through July and readily hybridizes with rainbow and cutthroat trout. This species is so popular with anglers that many fishermen hike to remote areas to test their skill against it.

Kamloops rainbow trout

The kamloops trout is a subspecies of rainbow trout capable of growing quite large in lakes that have abundant supplies of food. It was introduced into Lake Tahoe in 1956 as fingerlings; in 1961, 100,000 catchable-sized fish were stocked. The kamloops requires the same habitat as the rainbow trout.

Kokanee salmon

Kokanee salmon, a landlocked form of sockeye salmon, was introduced into Lake Tahoe in 1944. Although difficult to catch, the kokanee has become popular in larger lakes and reservoirs. Kokanee feed primarily on zooplankton, but larger fish take aquatic insects and sometimes small fishes. The kokanee is a true salmon in that its death occurs soon after spawning. It spawns in the fall in the Lake and its tributaries (chiefly in Taylor Creek) and competes with brown and brook trout where spawning habitat is limited.

Lahontan cutthroat trout

Cutthroat is the only trout species native to the Tahoe Region. It spawns in the spring. Its population has been greatly depleted by changes in its natural habitat, by competition, and by hybridization with the rainbow.

Lake trout

The lake trout, or mackinaw, along with brook trout, belongs to the Char group of the salmon family and was introduced to the Lake Tahoe Region in 1889. It is now the dominant game fish caught from the Lake and its ideal habitat is large, deep, well oxygenated lakes that maintain water temperatures below 55 degrees F°. Spawning occurs in the fall.

Mountain whitefish

The mountain whitefish, which is related to the trout, is native to the Truckee River drainage. It is silver-colored with a light brown to bluish back. It has a much smaller mouth than trout, but larger scales. This fish spawns in the fall in gravel riffles. Whitefish are good to eat, but anglers unfamiliar with the species sometimes discard them.

Rainbow trout

The rainbow evidently originally occurred on the western slope of the Sierra Nevada, but the white man has stocked it in lakes and streams throughout the crest and east slope. Rainbow trout normally spawn in spring and are easily raised in captivity. Hatchery-reared rainbows of catchable size are caught very easily; about 50 percent usually are taken within 12 days after a stream or lake is stocked.

Planting project

In a bi-state study of the Lake Tahoe fishery in the early 1960's, an experimental planting program tested various sizes and strains of trout for stocking. Results of this study led to the

present management program of annual planting of 35,000 pounds of large (about 12 inches) trout. Planting of fingerlings and small catchables proved to be unfeasible because of poor rates of survival. The limited supply of food in Lake Tahoe and other high alpine lakes probably is the most important factor controlling production of game fish.

NONGAME FISH

The species of nongame fish in this area are:

Brown bullhead	*Leictalurus nebulosus*
Golden shiner	*Notemigenus crysoleuscicas*
Lahontan mountain sucker	*Pantosteus lahontan*
Lahontan redside	*Richardsonius egregius*
Lahontan speckled dace	*Rhinichthys osculus robustus*
Mosquito fish	*Gambusia affinis*
Piute sculpin	*Cottus beldingii*
Tahoe sucker	*Catostomus tahoensis*
Tui chub	*Gila bicolor*

DISTRIBUTION

The distribution of all fish species known or presumed to be in the tributaries to Lake Tahoe is shown in Appendix A, tables 1 and 2, and on the map, Stream Fishery Occurrence, which immediately follows these tables.

ENVIRONMENTAL INFLUENCES

The aquatic system of Lake Tahoe and its tributaries is complex and interrelated. It includes Lake Tahoe, the minor lakes, and all the streams in the region. The aquatic vegetation, plankton, mollusks, aquatic insects, crustaceans, and fish compose the living portion of this system. Our knowledge about how this ecosystem operates is fragmentary; in fact, so little is known about some phases of this operation that it is difficult to propose realistic decisions about man's use of this ecosystem. Consequently, all we can do at this point is to report what is known definitely and consider it as a baseline for planning.

FOOD WEB REQUIREMENTS IN THE LAKE

Since the lake trout is the dominant game fish caught in Lake Tahoe, its needs are a primary consideration. Much of its diet is the piute sculpin, which, in turn, subsists on the ostracods (small crustaceans) and larvae of the midge fly. Lahontan redside is a minor element in this trout's diet. The ostracods live in the benthic zone (lake bottom) and feed on decomposing organic matter. Accordingly, to provide more food for the trout, opossum shrimp were introduced into the Lake in 1963, 1964, and 1965; they are now well established. These shrimp consume zooplankton, phytoplankton, and detritus.

Another experimental introduction, in 1964, 1965, and 1966, was the Bonneville cisco (*Prosopium gemmiferum* Snyder) from Bear Lake (elevation, 5912 ft.) in Utah and Idaho. Hopefully the cisco could supplement the food supply for the lake, rainbow, and brown trout populations. Lahontan speckled dace is not important as a source of food for Tahoe game fish.

Insects are known to be an important part of the fish food web[1/]; in fact, a healthy population of most of the native species of fish depends on continued existence of aquatic insects. Approximately 100 species of these insects that are part of the food chain of fish live in this region (Appendix B). We know that any human activity that drastically alters insect populations (e.g., mosquito abatement) inevitably affects the food supply of the fish. Removal of streamside vegetation or other important habitat can seriously reduce the insect portion of the food web and also affect water temperature. Likewise, use of nonselective and long-lived insecticides can adversely affect the fish; the nonselective formulations usually eliminate more insects than the target species and thus reduce the food supply, and the long-lived insecticides tend to become concentrated in body tissues of the fish.

1/ The *food web* is a series of interlinked *food chains.* A food chain is the process whereby energy stored in plants is passed through the biological community in a series of steps of eating and being eaten.

EFFECTS OF LAND DEVELOPMENT

Production of sediment

Many things indicate that land development activities are seriously affecting the fisheries of the Tahoe Region. The patterns of land development and its consequences, as they have occurred

elsewhere in California, are being repeated here. One of the most important and destructive of these consequences is the phenomenal increase of sedimentation, most of which originates on privately owned lands. The building of roads of all types contributes almost half of the total volume of sediment. How much is this volume? A study by the State of California in 1969 indicated that the total yield of sediment on the Upper Truckee River and Trout Creek watersheds alone amounted to some 30,000 tons per year.

Another study, the California-Nevada-Federal Joint Water Quality Investigation (1969), produced information on two sharply contrasted areas, Taylor and General Creeks, where little development has occurred, and on Upper Truckee River and Incline Creek, where development has been extensive. This report stated, in part:

> The benthic organisms obtained by Surber and Cage sampling yielded a variety of forms that are typical of clean, high Sierran streams. Species diversity was highest in Taylor and General Creeks, and lowest in Upper Truckee River and Incline Creek. Taylor and General Creeks supported almost twice as many kinds of the classically sensitive stream forms, stoneflies, mayflies, and caddisflies as Upper Truckee River and Incline Creek.

Short-term studies by the Foresta Institute (1967 and 1969) of sedimentation at the mouth of Third Creek in the Incline Village area clearly indicated that construction activities associated with land development are drastically increasing the rate of sedimentation.

In considering the seriousness of accelerated production of sediment, six effects of sediment upon fish and streams must be noted:

1. **Upon fish.** Turbidity ranges from 1,000 to 6,000 ppm for periods of 15 to 20 days have killed significant numbers of fish.
2. **Upon eggs and freshly hatched fish.** The finer sediment seals off or prevents free circulation of water in gravel and sand spawning beds. This water contains dissolved oxygen that is essential for survival of eggs and the young fish.
3. **Upon bottom organisms.** Sediment covers the types of aquatic habitat needed by various organisms; such covering kills them and thus adversely affects the food chain of the fish and reduces capability of the habitat to support fish.
4. **Upon aquatic plants.** Sediment can destroy aquatic plants by its grinding action, by covering them with silt, by cutting off light, or by a combination of these three actions.
5. **Upon chemical and physical characteristics of water.** Sediment is comparatively sterile but contains minor amounts of nutrients.
6. **Upon fish habitat and population.** In some streams enough sediment has been deposited to seriously reduce the value of a formerly high quality fishery. Sediment can fill pools so that game fish are eliminated because of lack of shelter. Fingerlings cannot survive without shelter.

Use of chemical insecticides

Land development anywhere has a single basic purpose: to attract increased numbers of persons to live or work there. Such development, when it occurs near sizable bodies of water whether they be lakes, reservoirs, rivers, or other streams, or even marshes, is likely to engender further activities associated with the comfort of the new residents; these include such projects as mosquito abatement and use of sprays to protect plants from insects or diseases. Until now, the activity that has received most attention is use of chemical insecticides.

Increased land development in the Tahoe Region is certain to bring demands for increased control of such pest insects as mosquitoes and various flies that bite and cause discomfort or

spread disease. Care must be taken to assure that chemical formulations used for control of such pests are both selective and short-lived; they should be used only when biological control techniques are not possible or as a strictly temporary measure.

Topographic modification

The greatest threat to populations of aquatic insects is the drastic change man is imposing on their habitat. Rechanneling streams, filling marshes, and various other "public works" projects directly threaten such insect habitat; less direct threats are posed by changes in the watershed that increase water runoff to a destructive level. Proposed land development projects alongside streams, lakes, marshes, or ponds or on steep watersheds should be studied carefully to prevent damage to the habitats of aquatic insects. Such threats arise from increased rates and volumes of runoff water; pollution by particulate matter (erosion) and by thermal pollutants, salts, oils, and detergents; release of soil nutrients; and by the direct changes in the insects' habitats mentioned above.

EFFECTS OF URBANIZATION ON THE ACQUATIC ECOSYSTEM [2/]

This preliminary report and synopsis of information about the role of the supporting organisms and plants in relation to the fisheries of the Lake Tahoe Region has revealed several startling facts. First is that our knowledge about the aquatic ecosystem of this lake and drainage has serious gaps. Second is that the scanty information now available is often not suitable as material for a base in making valid predictions about the effects of increased human population in the Region and how this increase relates to the fisheries. Finally, more time and study are needed to fill the information gaps, to study similar published accounts of effects of urbanization on mountain environments, and to gather together experts in environmental management to diagnose and evaluate the danger signs, their probable effects, and ways to remedy various unfavorable conditions.

As a result of the conditions stated above, information presented here is rather fragmentary and at best is an educated guess about what environmental conditions are now for the classes of flora and fauna studied. Similarly, the predictions of what conditions are likely to become following increased urbanization of tributary drainages and the resulting eutrophication of Lake Tahoe are essentially guesses. We now look at the major elements in the supportive aquatic ecosystem.

Plankton

The floating and attached forms of minute plant life (plankton) living in Lake Tahoe and its tributaries are collectively the most important organisms in the Tahoe fishery food web and also the most sensitive to change.

Phytoplankton

Changes in the plant life that are floating (phytoplankton) or attached to rocks and the bottom (periphyton) are already documented. Study of these forms of life is continuing to define better the extent of the changing growth rates of the phytoplankton and periphyton. This work by Dr. C. R. Goldman and his associates at the University of California, Davis, indicates an upward trend in the amount of growth approaching 70 percent in the last 10 years. Yearly fluctuations in growth rate based on seasonal changes in the weather and possibly changes in land use do not obscure the general upward trend in growth of algae. This increase may be due to an increased input of both organic and inorganic nutrient material by tributaries of Lake Tahoe as a result of man-caused accelerated erosion and of fertilizing land to suit his style of life.

The algae in Lake Tahoe have been found to be sensitive to minute changes in concentration of nutrients in the water in which they live. Bioassay cultures by several laboratories interested in the eutrophication problems of Lake Tahoe indicate that algae are particularly sensitive to nitrogen compounds. Nitrogen is brought into the Region to fertilize gardens, lawns, golf courses, and other culturally disturbed areas to promote desired plant growth. Some of this fertilizer surely is not used by plants and finds its way into the Lake through groundwater percolation, surface runoff, or rain.

It is not possible here to analyze and report in detail for individual species the abundance, distribution, importance, tolerance to pollution, and other significant characteristics of each type

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2/ This preliminary report prepared by Prof. Robert C. Richards, Instructor in Ecology, University of California, Davis, emphasizes effects on the plankton, mollusks, crustaceans, and aquatic vegetation.

of phytoplankton and periphyton. More than 100 species of phytoplankton and periphyton have already been identified, and the number is increasing. The population of algae in Lake Tahoe is typical of exceptionally clear, sterile mountain lakes of western North America. Diatoms are the form most prevalent in the main body of the Lake. Less desirable forms of algae are more abundant in protected areas and areas where tributaries from urban centers enter the Lake. These less desirable forms include the blue-green algae that are responsible for obnoxious "blooms" in more fertile lakes. They grow in protected marinas along the shores of the Lake and are telltale signs of impending changes that can occur there, given the correct physical and chemical conditions for growth.

The relation of the increase of algae to the Tahoe fishery is indirect but very important. As urbanization increases, two other phenomena occur; namely: the nutrients available for growth (because of sediment transport) increase, and alteration of physical conditions (e.g., rise of water temperature in summer, and decrease in light penetration) occurs. That is, numbers of some forms of more adaptable or pollution-tolerant algae will increase while the "clean water forms" will decrease. This will, in turn, alter the food source available to the next link in the food web, the zooplankton (animal plankton), which many of the juvenile fish and some adult game fish in the Lake use for food.

Zooplankton

The selective process just described will alter the composition of the zooplankton community and will also change the food supply now available to the Lake Tahoe fishery. The three major groups of zooplankton in Lake Tahoe and outlying lakes and tributaries are called *rotifers, copepods,* and *cladocerans.* Cladocerans and, less importantly, copepods are major food sources for small lake trout and some nongame fishes. The Bonneville cicso apparently feeds on all three groups to some extent. *Daphnia* and *Bosmina* are the more numerous cladocerans in Tahoe, while *Epischura* and *Diaptomus* are important copepods. Consumption of bottom-dwelling zooplankton in the Lake by the fishes is probably important in the shallow zone but it has not been studied.

The abundance, habitat preferences, and tolerance toward pollution of most Tahoe zooplankton are either unknown or the information is available only through exhaustive search of literature on the subject. Likewise, virtually nothing is known about zooplankton in outlying lakes except for Freihofer's limnological survey (1949) of the Echo Lakes. Several forms rare or absent from Lake Tahoe are in Echo Lakes probably because of the very different environmental conditions. Similar genera appear to be present in other small lakes in the Region. Except for Fallen Leaf, Echo, and possibly Spooner and Incline Lakes and Mill Creek Reservoir, urbanization should not affect the outlying lakes within the boundaries of wilderness areas or other areas under jurisdiction of the U. S. Forest Service. Of course, logging and associated forest use could be deleterious to communities of stream and lake plankton if they were not managed wisely.

We urgently need further comparative study of these outer lakes that are under man's influence and of the more remote lakes to determine whether changes in populations of plankton can be detected in similar environments that do and do not have histories of urbanization. Fallen Leaf and Cascade Lakes might provide a valid comparison.

Urbanization and increased human use of the area have had other effects besides altering the basic structure of the food web. Fishing pressure and the desire to supplement the fishery with more species of game fishes have led to introductions of several types. Manipulation of the top of the food web caused by introducing exotic species sometimes leads to changes in the plankton populations through selective grazing of some species by the introduced predatory game fish. This phenomenon has been observed and recorded in some lakes. Introduction of exotic fish has led to reduction of one zooplankter and increase of a less prevalent species that prefers a

different phytoplankton for food. Selective grazing of the phytoplankton can lead to a change in composition of the algal community and possible establishment of undesirable species that predominate as "bloom" or general nuisance algae.

A large zooplankter, the opossum shrimp *(Mysis relicta),* was recently introduced into the Tahoe Region and is now established in Lake Tahoe; hopefully it will be a forage food source for trout. Trawling by the California Department of Fish and Game in August 1970 indicated that these shrimp are distributed around the Lake in fairly large numbers. The status of other introductions into Echo and Fallen Leaf Lakes is unknown. Recent trawling by the Department has brought up no shrimp in either tributary lake, but shrimp have been recovered from Donner Lake (outside the Tahoe Region) in significant numbers. The *Mysis* recovered from Donner Lake averaged about one-third larger than those collected in Lake Tahoe at the same time. This suggests a foreseeable trend in growth of *Mysis* in Lake Tahoe. As Lake Tahoe becomes more eutrophic and quality of the water approaches that of Donner Lake, the shrimp should increase in size and value as a source of food for fish. (Zooplankton known to exist in the Lake Tahoe Region are listed in Appendix C.)

Mollusks

Only a few scattered sources of information about mollusks of the Tahoe Region are available. Freihofer collected a clam *(Pisidium* sp.) in Echo Lakes in 1949; this species is found in Lake Tahoe also. Van Der Schalie and Berry collected *Lymnaea, Gyralus,* and *Physa* during limited activities in 1934. These species appear not to be a significant source of food for lake trout but could be important to nongame fishes that feed on the bottom. Their distribution probably is regionwide, but nothing is known about their abundance or ability to tolerate changing environmental conditions, at least in this area. A recent checklist of invertebrates by Frantz and Cordone (1966) mentions two additional snails and provides the most extensive listing available of other lower phyla.

Personal observations made while SCUBA diving in the shallows near the mouth of the Upper Truckee River indicate that one snail, thought to be *Gyralus* sp., becomes very abundant in this sandy area in the fall. Trails left by this snail while foraging completely cover the bottom in some areas. A large bivalve, tentatively identified as *Margaritifera,* has also been collected in the turbid water and soft ooze bottom of a large South Shore marina.

Crayfish

The only species of crayfish known to live in Lake Tahoe *(Pacifastacus leniusculus* Dana) occurs throughout the littoral zone; it is also present in Fallen Leaf and Echo Lakes. Probably it has invaded larger and higher drainage lakes not blocked by natural barriers.

This species of crayfish appears to thrive now in Tahoe although its cold temperatures inhibit rapid growth. These crayfish have been collected at depths of 200 meters, but the maximum density of population (90 percent) lives at depths between 10 and 20 meters. Temperature appears to limit success of breeding at the lower limits of depth, and light intensity and wave action limit the distribution near shore. Abundance appears to be regulated by bottom type and local food supplies. Total population of the crayfish is estimated to be nearly 56 million individuals–an impressive population figure for the Tahoe environment; but the same crayfish are even more numerous and are larger than average size in the more eutrophic Donner Lake.

It is postulated that increased fertilization of Lake Tahoe should lead to development of a larger population of crayfish that will have both more and larger individuals. Tolerance to levels of water pollution that may be encountered soon should allow this species to continue living here.

The crayfish is indirectly important to fishermen because it is a major source of food for large trout. Not many people here use crayfish for food, but they are a culinary delight in Scandinavian countries.

Crayfish seem to be effective grazers and scavengers in the littoral zone, and this may be important in checking the growth of bottom-dwelling algae. The present population of crayfish may be helping to maintain the aesthetic value of Tahoe's clean bottom by grazing back aquatic vegetation to the lower limit of crustacean distribution. Abrahamsson and Goldman have suggested that limited harvesting of this crustacean might be a feasible method of removing nutrient from the Lake, but ecological implications of such a move could be both great and unfavorable.

Aquatic vegetation

The aquatic vegetation and the deep plant beds that are found in very few other lakes in the world are unusual. Generally the types and extent of aquatic vegetation and "beds" in Lake Tahoe and the outlying lakes and streams are poorly known. This is especially unfortunate in regard to Lake Tahoe because some researchers believe that these beds may serve as nursery food sources and protective cover for both small game fishes and nongame fishes like minnows. These areas, in turn, are haunted by larger predatory game fish searching for food.

Tahoe is unusual in containing deepwater plant beds that are found to depths of 120 meters because the water is so clear and light penetration is so good. Mapping the distribution of these beds by underwater television has been tried and an extensive area was surveyed by using bottom grab samples. Littoral subsurface beds appear off the Upper Truckee River delta, but very few others are visible from the air or water surface. *Potomogeton* spp. grow in this type of habitat. Protected areas (e.g., marinas and harbors) that have very clear water support occasional luxuriant growths of *Elodea* spp., *Chara,* and others.

At least two areas where mats of algae and other aquatic plants abound appear to be important. Both Agate Bay and an area offshore from the city of South Lake Tahoe support beds of algae, mosses, and liverworts. Important species were in the *Chara, Cladophora,* and *Vaucheria* genera. Mosses included *Fissidens, Hygrophypnum,* and *Leptodictyon,* and the liverwort *Chiloscyphus.* Frantz and Cordone found practically no plants below 137 meters.

Many species appeared to have preferred depth habitats. *Chara* ranged from 20 to 200 feet but was most abundant in shallow water; mosses and filamentous algae peaks were deeper. *Cladophora* made up 90 percent of the total community at the 350- to 400-foot level near South Lake Tahoe.

Changing conditions in the Lake resulting from urbanization along the shore may severely reduce these plant beds in deep water and consequently the composition of the Tahoe sport fishery. If siltation from streams and enrichment of the Lake continue, clarity of the water will decrease; this will shut off the light, already of low intensity, that reaches the deep plant beds. This may destroy--at least alter--the composition of these aquatic plant beds and produce conditions detrimental to the organisms in these areas that support the fishery. On the other hand, the increasing sediment load may provide more suitable plant growth substrate in shallower areas and lead to an increase in cover of plant beds on the bottom. Personal observations while SCUBA diving in a very turbid lakeshore marina indicate that plant growth can be limited to less than 20 feet depth where little light penetrates.

If the levels of light penetration decrease and if upward encroachment of the plants is necessary to maintain them, they might gradually disappear, especially if crayfish maintain their lower

distribution level and graze back the vegetation as effectively as Abrahamsson and Goldman suggest.

Though aquatic vegetation in outlying lakes and streams is poorly known, it seems likely to be somewhat similar to that in the shallow areas of Lake Tahoe. Plant genera similar to those found in the deepwater beds of Tahoe are expected in the smaller lakes' shallow areas, but the species may differ.

In summary, it appears that plants and animals most likely to be directly affected by urbanization are those that inhabit the narrow offshore shelf of Lake Tahoe and the streams and lakes in culturally disturbed areas. As the Lake becomes more fertile, as light penetration decreases, and as increasing plankton growth occurs in the shallows, there will be a compression of life zones so that once separated organisms will overlap in their ecological niches. The result of this will surely be a change in the structure of the Lake Tahoe aquatic community.

PROBLEMS, CONSEQUENCES, AND SUGGESTED CONTROLS

The committee on the fishery of the Lake Tahoe Region has identified several specific continuing problems and the consequences of permitting these problems to continue unsolved. These problems, the consequences, and suggested controls or means of prevention are set forth below.

PROBLEM	CONSEQUENCES	SUGGESTED CONTROLS
Silt produced by soil disturbance reaches streams; some eventually reaches the lake.	Sediment deteriorates the natural habitat of fish and reduces reproduction.	Retain all potential sediment on site where disturbance occurs. The intent is to prevent discharge of polluting sediment.
Silt is produced by improper land use such as:		
1. Overgrazing of vegetative cover by livestock	Reduction of density of vegetation causes erosion to start. This produces sediment that pollutes streams and lakes.	Limit grazing to carrying capacity of the forage.
2. Cross-country travel by 4-wheel-drive vehicles and motorcycles	This practice destroys natural vegetation and induces rilling, which, in turn, accelerates erosion, which produces sediment.	Confine these vehicles to roadways designed and maintained to accept this use without causing erosion.
Removal of streamside vegetation and disturbance of ground cover adjacent to streams	Destroys habitat of useful insects and stream bank stabilization. Removes natural cover that creates shelter and insulation. Disrupts the natural filtering action of the land.	Establish streamside environmental zones on each side of the stream wide enough to protect the aquatic habitat established through on-site investigations by fishery biologists and other specialists.
Changing stream channels	This activity is rarely designed or constructed properly and almost always destroys aquatic habitat.	No changes of any channels. Require projects to be designed to fit the channel rather than permitting change of channel to fit the project.
Culvert installations	Culverts usually become barriers to fish passage or plug up during high flows and cause fills to wash out.	Bridge perennial stream courses. Use culverts only on intermittent streams and design them to prevent plugging and washouts.

Destruction of marshes	This activity destroys the most productive wildlife habitat in the Region. It also destroys several links in the fish food chain and the reproductive cycle.	No development activities on marshes. Prevent direct use of all pesticides on marshes. Establish buffer strip around marshes to protect the natural inhabitants of the marsh.
Diversion of water from streams	Such diversion from small streams can degrade the aquatic habitat or destroy it during dry years or periods of low flow.	Make no diversions of water from any Tahoe Region stream. All water supplies should be obtained from wells or from Lake Tahoe.
Increased use of hazardous pesticides	Long-lived nonselective pesticides increase in concentration as they pass upward through the food chain. Nonselective formulations destroy useful insects as well as the target species. Long-lived ones concentrate in the tissues of fish and other consumers.	Use only those pesticides that have been scientifically proved to be environmentally safe. Use pesticides that are selective, and have been approved by appropriate Fish and Game Departments and public health agencies.
Some habitat improvement and water yield improvement projects do more harm than good.		Qualified personnel make complete investigation of proposed projects including all known or suspected ramifications. Projects be reviewed by the appropriate governmental agencies before any work is allowed to start.
Introduction of new species	A new species could completely upset the present balance in the ecosystem.	Qualified personnel make complete environmental investigation of needs of the proposed species and of existing ecological relations that might be endangered. No introduction of new species unless it is shown that no adverse ecological effects would follow.
Public agencies lack legal right to cross private lands to inspect stream channels.	Personnel of public agencies are prevented from inspecting stream banks and channels–a necessary part of stream protection. Consequent damage to the streamside and channel on private land negates benefits of protection on publicly owned lands.	Provide access to streams by authorized personnel for environmental inspections and necessary stream maintenance on private land.

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APPENDIXES

A. Table 1–Distribution of fish in tributaries to Lake Tahoe, California side

Table 2–Distribution of fish in tributaries to Lake Tahoe, Nevada side

Map: Stream Fishery Occurrence

B. Insects native to the aquatic habitats of the Lake Tahoe Region

C. Zooplankton in the Lake Tahoe Region

D. Invertebrates and aquatic plants of Lake Tahoe

E. Table 3.--Distribution of fish by species, and location and area of small lakes and reservoirs in the Lake Tahoe Region.

APPENDIX A

Table 1. **Distribution of fish in tributaries to Lake Tahoe, California side**

Stream & Species	Occurrence	Approximate distribution	Migration pattern
Griff Creek			
Rainbow trout	Known	From mouth upstream 1.5 miles	Juveniles are year-round residents. In spring adults move upstream to spawn.
Eastern brook trout	Probable	Uppermost headwater	Resident
Dace	Known	Lowermost 2 mi.	Semi-migrant to and from Lake Tahoe
Sucker	Known	Lowermost 2 mi.	Semi-migrant to and from Lake Tahoe
Carnelian Canyon			
Rainbow trout	Probable	Lower 1 mi.	Juveniles are year-round residents. In spring adults move upstream to spawn.
Eastern brook trout	Probable	Uppermost headwater	Resident
Watson Creek			
Rainbow brook trout	Probable	From mouth upstream 2 mi.	Juveniles are year-round residents. In spring adults move upstream to spawn.
Eastern brook trout	Probable	Uppermost headwater	Resident

Watson Creek (Con't)			
Dace	Probable	Lowermost 2 mi.	Semi-migrant to and from Lake Tahoe
Sucker	Probable	Lowermost 2 mi.	Semi-migrant to and from Lake Tahoe
Dollar Creek			
Rainbow trout	Known	From mouth upstream 1 mi.	Juveniles are year-round residents. In spring adults move upstream to spawn.
Eastern brook trout	Probable	Uppermost headwater	Resident
Burton Creek			
Rainbow trout	Known	From mouth upstream 2.5 mi.	Juveniles are year-round residents. In spring adults move upstream to spawn.
Brown trout	Known	From mouth upstream 2.5 mi.	In autumn adults move upstream from Lake Tahoe to spawn
Kokanee salmon	Known	Stream mouth only	In autumn, adults move from Lake Tahoe into estuary to spawn.
Lahontan red-side	Probable	Mouth only	Resident in estuary
Dace	Probable	Mouth only	Resident in estuary
Sucker	Known	Mouth only	In spring adults move from Lake Tahoe into estuary to spawn.
Tui chub	Known	Mouth only	Resident in estuary
Piute sculpin	Probable	Mouth only	Resident in estuary
Mountain whitefish	Probable	Mouth only	In fall adults move into estuary to spawn.

Ward Creek

Rainbow trout	Known	From mouth upstream 4 mi.	Juveniles are year-round residents. In spring adults move upstream to spawn.
Brown trout	Known	From mouth upstream 4 mi.	In autumn adults move upstream from Lake Tahoe to spawn.
Eastern brook trout	Known	Entire stream	Resident
Kokanee salmon	Known	From mouth upstream 3 mi.	In autumn adults move from Lake Tahoe into estuary to spawn.
Mountain whitefish	Known	From mouth upstream 3 mi.	In fall adults move from Lake Tahoe into estuary to spawn.

Blackwood Creek

Rainbow trout	Known	From mouth upstream 4 mi.	Juveniles are year-round residents. In spring adults move upstream to spawn.
Brown trout	Known	From mouth upstream 4 mi.	In autumn adults move upstream from Lake Tahoe to spawn.
Eastern brook trout	Known	Entire stream	Resident
Kokanee salmon	Known	From mouth upstream 3 mi.	In autumn adults move from Lake Tahoe into estuary to spawn.
Lahontan red-side	Probable	From mouth upstream 1 mi.	Resident
Dace	Probable	From mouth upstream 1 mi.	Resident
Sucker	Probable	From mouth upstream 3 mi.	In spring adults move from Lake Tahoe into estuary to spawn.

Blackwood Creek (Con't)			
Tui chub	Probable	Stream mouth only	Resident in estuary
Piute sculpin	Probable	Stream mouth only	Resident in estuary
Mountain whitefish	Known	From mouth upstream	In fall adults move from Lake Tahoe into estuary to spawn.
Madden Creek			
Rainbow trout	Probable	From mouth upstream	Juveniles are year-round residents. In spring adults move upstream to spawn.
Eastern brook trout	Probable	Entire stream	Resident
Homewood Creek			
Rainbow trout	Probable	From mouth upstream 1 mi.	Juveniles are year-round residents. In spring adults move upstream to spawn.
Eastern brook trout	Probable	Entire stream	Resident
McKinney Creek			
Rainbow trout	Known	From mouth to McKinney Lake	Juveniles are year-round residents. In spring adults move upstream to spawn.
Eastern brook trout	Known	Stream mouth only	In autumn adults move from Lake Tahoe into estuary to spawn.
Kokanee salmon	Known	Stream mouth only	In autumn adults move from Lake Tahoe into estuary to spawn.
Brown trout	Known	From mouth to McKinney Lake	In autumn adults move from Lake Tahoe upstream to spawn.

McKinney Creek (Con't)

Mountain whitefish	Known	Stream mouth only	In fall adults move from Lake Tahoe into estuary to spawn.
Dace	Probable	Stream mouth only	Resident
Sucker	Probable	Stream mouth only	In spring adults move from Lake Tahoe into estuary to spawn.
Tui chub	Probable	Stream mouth only	Resident in mouth
Piute sculpin	Probable	Stream mouth only	Resident in mouth

General Creek

Rainbow trout	Known	From mouth upstream 5 mi.	Juveniles are year-round residents. In spring adults move upstream to spawn.
Eastern brook trout	Known	Entire stream	Resident
Brown trout	Known	From mouth upstream 5 mi.	In autumn adults move from Lake Tahoe into estuary to spawn.
Kokanee salmon	Probable	Mouth only	In autumn adults move from Lake Tahoe upstream to spawn.
Mountain whitefish	Probable	Stream mouth only	In fall adults move from Lake Tahoe into estuary to spawn.
Sucker	Probable	Stream mouth only	In spring adults move from Lake Tahoe into estuary to spawn.

Meeks Creek

Rainbow trout	Known	From mouth upstream 4 mi.	Juveniles are year-round residents. In spring adults move upstream to spawn.

Meeks Creek (Con't)			
Eastern brook trout	Known	Entire stream	Resident
Brown trout	Known	From mouth upstream 4 mi.	In autumn adults move upstream from Lake Tahoe to spawn.
Kokanee salmon	Probable	Estuary only	In autumn, adults move from Lake Tahoe into estuary to spawn.
Mountain whitefish	Known	From mouth upstream	In fall adults move from Lake Tahoe into estuary to spawn.
Lahontan red-side	Probable	Estuary only	Resident
Dace	Probable	Estuary only	Resident
Sucker	Probable	From mouth upstream 3 mi.	In spring adults move from Lake Tahoe into estuary to spawn.
Tui chub	Probable	Estuary only	Resident
Piute sculpin	Probable	Estuary only	Resident
Lonely Gulch Creek			
Rainbow trout	Probable	Entire stream	Juveniles are year-round residents. In spring adults move upstream to spawn.
Eastern brook trout	Probable	Entire stream	Resident
Rubicon Creek			
Rainbow trout	Probable	Entire stream	Juveniles are year-round residents. In spring adults move upstream to spawn.
Eastern brook trout	Probable	Entire stream	Resident

Eagle Creek			
Rainbow trout	Known	Entire stream	Juveniles are year-round residents. In spring adults move upstream to spawn.
Eastern brook trout	Known	Entire stream	Resident
Brown trout	Known	Entire stream	In autumn adults move upstream from Lake Tahoe to spawn.
Kokanee salmon	Known	Lower 0.25 mi.	In autumn adults move from Lake Tahoe into estuary to spawn.
Mountain whitefish	Probable	Lower 0.25 mi.	In fall adults move from Lake Tahoe into estuary to spawn.
Lahontan red-side	Probable	Lower 0.25 mi.	Resident
Dace	Probable	Estuary	Resident
Sucker	Probable	Lower 0.25 mi.	In spring adults move from Lake Tahoe into estuary to spawn.
Tui chub	Probable	Estuary	Resident
Piute sculpin	Probable	Estuary	Resident
Cascade Creek			
Rainbow trout	Probable	Entire stream	Junveniles are year-round residents. In spring adults move upstream to spawn.
Eastern brook trout	Probable	Entire stream	Resident
Brown trout	Probable	Entire stream	In fall adults move from Lake Tahoe into estuary to spawn.

Tallac Creek

Rainbow trout	Probable	Entire stream	Juveniles are year-round residents. In spring adults move upstream to spawn.
Eastern brook trout	Probable	Entire stream	Resident
Brown trout	Probable	Entire stream	In fall adults move from Lake Tahoe into estuary to spawn.
Mountain whitefish	Probable	Lower 3 mi.	In fall adults move from Lake Tahoe into estuary to spawn.

Taylor Creek

Rainbow trout	Known	Entire stream stocked as catchable-sized trout during open season	Juveniles are year-round residents. In spring adults move upstream to spawn.
Brown trout	Known	Entire stream	In autumn adults move from Lake Tahoe upstream to spawn
Kokanee salmon	Known	Entire stream	In autumn adults move from Lake Tahoe into estuary to spawn.
Eastern brook trout	Known	Entire stream	Resident
Lahontan red-side	Known	Estuary only	Resident
Dace	Known	Estuary only	Resident
Sucker	Known	Entire stream	In spring adults move from Lake Tahoe into estuary to spawn.
Tui chub	Known	Estuary only	Resident
Piute sculpin	Known	Estuary only	Resident

Taylor Creek (Con't)			
Mountain whitefish	Known	Entire stream	In fall adults move from Lake Tahoe into estuary to spawn.
Upper Truckee River			
Rainbow trout	Known	Entire stream	Juveniles are year-round residents. In spring adults move upstream to spawn.
Kokanee salmon	Known	Lower 12 mi.	In autumn adults move from Lake Tahoe into estuary to spawn.
Brown trout	Known	Entire stream	In autumn adults move from Lake Tahoe up-stream to spawn.
Eastern brook trout	Known	Entire stream	Resident
Lahontan red-side	Known	Lower 10 mi.	Resident
Dace	Known	Lower 10 mi.	Resident
Sucker	Known	Lower 10 mi.	In spring adults move from Lake Tahoe into estuary to spawn.
Tui chub	Known	Lower 10 mi.	Resident
Piute sculpin	Known	Estuary	Resident
Mountain whitefish	Known	Lower 12 mi.	In fall adults move from Lake Tahoe into estuary to spawn.
Golden shiner	Probable	Estuary	Resident
Brown bullhead	Probable	Estuary	Resident
Mosquitofish	Probable	Estuary	Resident

Trout Creek

Rainbow trout	Known	Lower 10 mi.	Juveniles are year-round residents. In spring adults move upstream to spawn.
Kokanee salmon	Known	Estuary	In autumn adults move from Lake Tahoe into estuary to spawn.
Brown trout	Known	Lower 10 mi.	In autumn adults move upstream from Lake Tahoe to spawn.
Eastern brook trout	Known	Entire stream	Resident
Lahontan red-side	Known	Estuary	Resident
Dace	Known	Estuary	Resident
Sucker	Known	Lower 6 mi.	Semi-migrant to and from Lake Tahoe
Tui chub	Known	Estuary	Resident
Piute sculpin	Known	Estuary	Resident
Mountain whitefish	Known	Lower 6 mi.	In fall adults move from Lake Tahoe into estuary to spawn.
Golden shiner	Probable	Estuary	Resident
Brown bullhead	Probable	Estuary	Resident
Mosquitofish	Probable	Estuary	Resident

Table 2.-- Distribution of fish in tributaries to Lake Tahoe, Nevada side

Stream & Species	Occurrence	Approximate distribution	Migration pattern
First Creek			
Eastern brook trout	Probable	From mouth to 1-1/2 mi.	Resident
Rainbow trout	Probable	From mouth to 1-1/2 mi.	Resident and migratory
Kamloops trout	Probable	Lower section	Undetermined
Second Creek			
Eastern brook trout	Probable	From mouth to 2-1/2 mi.	Resident
Rainbow trout	Probable	From mouth to 2-1/2 mi.	Resident and migratory
Wood (Rose) Creek			
Eastern brook trout	Known	From mouth to 3 mi.	Resident
Rainbow trout	Known	From mouth to 3 mi.	Resident and migratory
Kamloops trout	Uncertain	Lower section	Undetermined
Cutthroat trout		Lower Section	Undetermined
Lahontan red-side	Known	Lower section	Migratory
Dace	Known	Lower section	Migratory
Third Creek			
Eastern brook trout	Known	Mouth to 3 mi.	Resident
Brown trout	Probable	Lower section	Migratory

Third Creek (Con't)			
Kamloops trout	Known	Lower section	
Cutthroat trout	Known	Lower section	
Kokanee salmon	Known	Lower section	Migratory
Dace	Known	Lower section	Migratory
Tui chub	Known	Lower section	Migratory
Sucker	Known	Lower section	Migratory
Incline Creek			
Eastern brook trout	Known	From mouth to 3 mi.	Resident
Brown trout	Probable	Lower section	Migratory
Rainbow trout	Known	From mouth to 3 mi.	Resident and migratory
Kamloops trout		Lower section	
Kokanee salmon	Known	Lower section	Migratory
Lahontan red-side	Probable	Lower section	Migratory
Dace	Probable	Lower section	Migratory
Tui chub	Probable	Lower section	Migratory
Sucker	Probable	Lower section	Migratory
Mill Creek			
Eastern brook trout	Probable	One-half mi.	Resident
Tunnel Creek			
Eastern brook trout	Probable	One and one-half mi.	Resident

Bondpland Creek			
Eastern brook trout	Known	One mi.	Resident
Kamloops trout	Known	Lower section	
Marlette Creek			
Eastern brook trout	Known	From mouth to 1-1/2 mi.	Resident
Rainbow trout	Known	Lower section	Resident and migratory
Kamloops trout	Known	Lower section	
Cutthroat trout	Probable	From mouth to 1-1/2 mi.	
Kokanee salmon	Known	Lower section	
Lahontan red-side	Probable	Lower section	Migratory
Dace	Probable	Lower section	Migratory
Sucker	Probable	Lower section	Migratory
Secret Harbor Creek			
Eastern brook trout	Probable	From mouth to 2 mi.	Resident
Rainbow trout	Known	Lower section	Resident and migratory
Kamloops trout	Known	Lower section	
Cutthroat trout	Probable	From mouth to 2 mi.	
Bliss Creek			
Eastern brook trout	Probable	One mi.	Resident

North Canyon & Slaughterhouse Creek			
Eastern brook trout	Known	From mouth to 5-1/2 mi.	Resident
Rainbow trout	Known	From mouth to 5-1/2 mi.	Resident and migratory
Cutthroat trout	Known	From mouth to 5-1/2 mi.	
Lahontan redside	Probable	Lower section	Resident and migratory
Dace	Probable	Lower section	Resident and migratory
Tui chub	Probable	Lower section	Resident and migratory
Sucker	Probable	Lower section	Resident and migratory
Glenbrook Creek			
Eastern brook trout	Probable	From mouth to 2 mi.	Resident
Rainbow trout	Probable	Lower section	Resident and migratory
North Logan House Creek			
Eastern brook trout	Probable	From mouth to 1-1/2 mi.	Resident
Logan House Creek			
Eastern brook trout	Probable	From mouth to 3 mi.	Resident
Lincoln Creek			
Eastern brook trout	Probable	Three and one-half mi.	Resident

Zephyr Creek			
Eastern brook trout		Three mi.	Resident
McFaul Creek			
Eastern brook trout	Probable	Four mi.	Resident
Burke Creek			
Eastern brook trout	Probable	Three mi.	Resident
Edgewood Creek			
Eastern brook trout	Known	From mouth to 5 mi.	Resident
Rainbow trout	Known	Lower section	Resident and migratory
Kamloops trout	Known	Lower section	
Incline Lake			
Rainbow trout	Known		
Marlette Lake			
Eastern brook trout	Known		
Cutthroat trout	Known		
Sucker	Known		
Spooner Lake			
Cutthroat trout	Probable		

APPENDIX B

Insects native to the aquatic habitats of the Tahoe Region [1/]

SPECIES	HABITAT
Diptera (flies)	
Tipulidae (water spiders)	
Tipula newcomeri	Margins of streams and ponds
Limnophila freeborni	same
Oromosia pernodosa	same
Polymeda burra	same
Culicidae (long-legged two-winged flies)	
Eucorethra underwoodi	Pools and overflow of streams
Culex tarsalis	Marshes
C. territans	same
Culiseta inornata	same
C. impatiens	same
Aedes fitchii	same
Dixidae	
Dixa sp.	same
Simuliidae (small biting two-winged flies)	
Cnephia mutata	Flowing streams
Simulium venustum	same
Chironomidae	
Pentaneura carnea	Lake Tahoe
Procladius bellus	Profundal zones of northern lakes
P. culiciformis	same
Paratendipes albimanus	Weedy coves of larger rivers; bays of lakes
Polypedilum laetum	same
P. isocercus	same
Stenochironomus taeniapennis	same
Tanytarsus dyari	same
T. guagga	same
Chryptochironomus digilatus	same
Tendipes spp.	same

[1/] Compiled by Bill Tisher and Fred Roberts

SPECIES	HABITAT
Stratiomyidae	
Euparyphus flaviventris	Edge of small streams
E. tahoensis	same
Stratiomys discaloides	Ponds or streams
Tabanidae	
Tabanus sp.	Marshes and ponds
Chrysops sp.	same
Lepidoptera (butterflies and moths)	
Usingeriessa brunnildalis	Streams; very little known regarding specifics
Paragyractis truckeealis	Cold flowing streams
Odonata (dragonflies and damselflies)	
Anisoptera (dragonflies)	
Ophiogomphus spp.	Gravelly beds of mountain lakes & streams
Gomphus confraternus donneri	Clear mountain lakes
Somatochlora semicircularis	Swamps or spring bogs
Zygoptera (damselflies)	
Coenagrion resolutum	Reedy margins of streams and rivers
Ishneura spp.	Lakes, ponds, swamps and streams in quiet, vegetation-chocked water
Plecoptera (stone flies)	
Plecoptera cora	Streams
Nemoura spp.	same
Leuctra spp.	same
Capnia spp.	same
Brachyptera vanduzeii	same
Oroperla barbara	same
Arcynopteryx yosemite	same
Isogenus spp.	same
Isoperla spp.	same
Acroneuria spp.	same

SPECIES	HABITAT
Ephemeroptera	
Hepategenia ruboventris	Small streams
Rhythrogena sp.	Fast-flowing streams
Cinygimula tioga	Small streams
Iron dulciana	Fast cold streams
Ironopsis grandis	
Ameletus imbellis	Fast and slow streams
Paraleptophelbia associata	Slow or moderately slow streams
Ephemerella glacialis	Streams
Callibaetis pacificus	Lake, ponds and streams
Megaloptera (Dobsonflies, alderflies, fishflies)	
Sialidae (Alderflies)	
Sialis occidens	Well aerated standing or moderately running water
Corydalidae (dobsonflies, fishflies)	
Dysmicohermes crepusculus	Coarse or rubble bottoms of stream beds
Protochauliodes montivagus	same
Hemiptera (wingless bugs)	
Corixidae (waterboatmen)	
Graptocorixa californica	Quiet pools of streams
Callicorixa audeni	same
Sigara spp.	same
Coenocorixa spp.	same
Notonectidae (backswimmers)	
Notonecta unifasciata	Quiet waters of lakes and streams
Nepidae (water scorpions)	
Ranatra fusca	Shallow water among sticks and plants
Belastomatidae (giant water bugs)	
Lethocercus americanus	Ponds and quiet pools in streams
Gelastocoridae (toad bugs)	
Gelastocoris oculatus	Sandy and muddy shores of ponds & streams

SPECIES	HABITAT
Gerridae (waterstriders)	
Gerris remigis	Ponds , lake margins, pools and streams
Veliidae (riffle bugs)	
Microvelia sp.	Ponds or quiet pools of streams
Rhagovellia sp.	Swiftest riffles of streams
Mesoveliidae	
Mesovelia mulsanti	Ponds and other bodies of standing water
Collembolla	
Achorutes armatus	Fish ponds
Onychiurus fimetarius	same
Xenylla humicola	Marsh lands bordering ponds
Symnthurides malmgreni	Fresh water
S. aquaticus	Quiet streams
Trichoptera (caddisflies)	
Rhyachopila valuma	Clear, cold, fast flowing streams
Glossosoma califica	Streams
Dolophilodes aequalis	same
Wormaldia sp.	Clear rapid streams
Polycentropus variegatus	Shores of lakes
Arctopsyche grandis	Fast flowing streams
Parapsyche elsis	same
Leuchotrichia pictipes	Ponds and large lakes
Dicosmoecus atripes	Lakes or large, slow moving streams
Limnephelis morrisoni	Along streams, lakes or ponds
L. secludens	same
Psychoglypha bella	same
P. ormiae	same
Neophylax occidentis	Rapidly flowing streams
Ecclisomyia simulata	Cold rapidly flowing mountain streams
Athripsodes annulicornis	Lakes, ponds or streams
Lepidostoma rayneri	same
Coleoptera (beetles)	
Amphizoidae	
Amphizoa insolens	Streams and rivers

SPECIES	HABITAT
Dytiscidae	
Laccophilus decipiens	Lakes, streams and rivers
Bidessus affinis	same
Hygrotus nigrescens	same
Hydroporus funestus	same
Agabus obliterus	same
Colymbetes rugipennis	same
Gyrinidae	
Gyrinus picipes	Lakes and ponds
Hydrophilidae	
Berosus maculosus	Marshes; weedy, shallow ponds
Crenitis alticda	same
Elmidae	
Heterlimnus corpulentus	Rapid streams

APPENDIX C

ZOOPLANKTON IN THE LAKE TAHOE REGION

In the following list, items followed by T have been found in Lake Tahoe. The others are believed to be only in outlying lakes.

Or.	*Mysidacea*		Or.	*Cladocera* (conc.)	
	Mysis relicta	T		*Alona quadrangularis*	T
Or.	*Cladocera*			*Pleuroxus denticulatus*	T
	Daphnia pulex (pulicaria)	T		*Chydorus latus*	T
	D. rosea	T		*C. sphaericus*	T
	D. longispina		Or.	*Copepoda*	
	Bosmina longirostris	T		*Epischura nevadensis*	T
	B. coregoni			*Diaptomus tyrelli*	T
	Holopedium gibberum			*Cyclops vernalis*	T
	Simocephalus serrulatus	T		*Macrocyclops albidus*	T
	Latona setifera	T	Ph.	*Rotatoria*	
	Drepanothrix dentata	T		*Notholca* sp.	T
	Ilyocryptus acutifrons	T		*Keratella sp.*	
	Eurycercus lamellatus	T		*Synchaeta* sp.	T
	Camptocercus rectirostris	T		*Asplanchna* sp.	
	Acroperus harpae	T		*Kellicotia longispina*	T
	Alona affinis	T		*Polyarthra* sp.	

APPENDIX D

Invertebrates and aquatic plants of Lake Tahoe [1/]

1. Sponges
   a. *Spongilla* sp.
2. Hydras
   a. *Hydra* sp.
3. Planarians
   a. *Phagocata tahoena* (1) [2/]
   b. *Dendrocoelopsis hymanae* (2)
4. Roundworms
   a. *Cobbonchus* sp.
5. Aquatic earthworms
   a. *Arcteonasis lamondi*
   b. *Uncinais uncinais*
   c. *Poloscolex beetoni* (1)
   d. *Limnodrilus hoffmeisteri*
   e. *Isochaeta nevadana* (2)
   f. *Psammoryctides minutus*
   g. *Rhyacodrilus sodalis*
   h. *R. sodalis*
   i. *Ilvodrilus frantzi*(1)
   j. *Haplotaxis* sp.
   k. *Rhynchelmia rostrata*
   l. *Kincaidiana freidris*
6. Leeches
   a. *Holobdella stagnalis*
   b. *Illinobdella moorei*
   c. *Erpobdella punctata*
7. Water fleas
   a. *Latona setifera*(2)
   b. *Daphnia rosea*
   c. *D. pulex*(1)
   d. *Simocephalis serrulatus*(2)
   e. *Bosmina longirostris*
   f. *Drepanothrix dentata*(2)
   g. *Ilvocryptus acutifrons*(2)
   h. *Eurycercus lamellatus* (1)
   i. *Camptocercus rectirostris* (2)
   j. *Acroperus harpae* (2)
   k. *Alona affinis* (1)
   l. *A. quadrangularis* (2)
   m. *Pleuroxus denticulatus* (2)
   n. *Chydorus latus* (2)
   o. *C. sphaericus* (2)
8. Clam shrimps
   a. *Candona tahoensis*
   b. *Uncinocythere* sp.
9. Copepods
   a. *Epischura nevadensis* (1)
   b. *Diaptomus tyrrelli* (1)
   c. *Cyclops vernalis*
   d. *Macrocyclops albidus*
   e. *Salmincola edwardsii*
10. Scuds
    a. *Hyalella azteca*
    b. *Hyalella inermis*
    c. *Stygobromus* sp.

1/ Compiled by Ted Frantz, Nevada Department of Fish and Game, from "A preliminary checklist of invertebrates collected from Lake Tahoe, 1961-1964," with some additions and changes.

2/ (1) = Widespread (2) = Infrequent

11. Crayfish

    a. *Pacifastacus leniusculus* (1)

12. Mayfly nymphs

    a. *Paraleptophlebia* spp.
    b. *Tricorythodes fallax*
    c. *Choroterpes* sp.
    d. *Heptagenia* sp.
    e. *Siphlonurus* sp.
    f. *Centroptilium*
    g. *Callibaetis* sp.

13. Dragon nymphs

    a. *Gomphus kurilis* (2)

14. Stonefly nymphs

    a. *Capnia lacustra* (1)
    b. *C. tahoensis* (2)
    c. *Nemoura* sp. (2)
    d. *Acroneura* sp.

15. Giant water bugs

    a. *Lethocerus americanus*

16. Water beetles

    a. *Hydroporus striatellus*
    b. *Agabus disintegratus*
    c. *Colymbetes rugipennis*
    d. *Tropisternus ellipticus*
    e. *Laccobius ellipticus*

17. Caddisfly larvae

    a. *Hydroptila* sp.
    b. *Limnephilus* sp.
    c. *Hesperophylax* sp.

18. Midge larvae

    a. *Palpomyis* sp. (2)
    b. *Pentaneura* sp. (2)
    c. *Ablabesmyia nonilis* (2)
    d. *Natarsia (possibly florens)* (2)
    e. *Procladius bellus?* (1)

18. Midge larvae (continued)

    f. *Syndiamesa pertinax* (2)
    g. *Prodiamesa bathyphila* (1)
    h. *Metrocnemis* (near) *lundbecki* (1)
    i. *Paratrichocladius* sp. (2)
    j. *Orthocladius obumbratus* (2)
    k. *Cryptochironomus* (near) *fulvus*
    l. *Harnischia* (near) *nais* (1)
    m. *H.* sp.
    n. *Polypedilum* (near) *scalaenum* (2)
    o. P. *parascalaenum*?
    p. *Encrochironomus* (near) *nigricans* (1)
    q. *Phaenopsectra* (near) *profusus* (2)
    r. *Tendipes* (near) *modestra* (2)
    s. *Tanytarsus* spp. (4 species) (2)
    t. *T.* (near) *guerla* (2)

19. Water mites

    a. *Lobertia* sp. (1)
    b. *Hydrovolzia* sp. (1)
    c. *Hygrobates* sp.
    d. *Limnesia* sp.
    e. *Piona* sp. (2)

20. Snails

    a. *Physa virgata*
    b. *Lymnaea bulimoides*? (2)
    c. *Carinifex newberryi*
    d. *Parapholyx effusa*
    e. *Ferrissia fragilis* (2)

21. Clams

    a. *Pisidium* sp. (1)
    b. *Littoridina ?* sp. (2)

APPENDIX D

Aquatic Plants in Lake Tahoe [3]

1. Deepwater algae

    a. *Cladophora glomerata* (1) [4]
    b. *Zoochlorella parasitica* (2)
    c. *Chara contraria* (2)
    d. *C. delicatula* var. *annulata*(1)
    e. *C. delicatula* var. *barbata* (2)
    f. *Vaucheria* sp.(1)
    g. *Schizothrix calciocola* (2)

2. Shallow water algae

    a. *Microspora wittrockii*
    b. *Spirogyra* sp.
    c. *Chara delicatula* var. *annulata*

3. Deepwater mosses

    a. *Fissidens adiantoides* (2)
    b. *F. grandifrons* (1)
    c. *Brachythecium* sp.(2)
    d. *Eurhynchium* sp.(1)
    e. *Hygrophypnum* sp.(3)
    f. *H. molle*(1) & (3)
    g. *Leptodictyum riparium* (1)
    h. *L. riparium* (forma) *fluitans* (2)
    i. *Porothamnium bigelovii* (2)
    j. *Fontinalis nitada* (2)

4. Deepwater liverworts

    a. *Blepharostoma arachanoideum* (2)
    b. *Chiloscyphus fragilis* (1)

5. Higher plants

    a. *Anacharis canadensis*
    b. *Myriophyllum* sp.
    c. *Potamogeton crispus*

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[3] Compiled from "Observations on deepwater plants in Lake Tahoe, California and Nevada."
[4] (1) = Widespread (2) = Infrequent (3) = Identification uncertain

This publication is one of a group issued jointly by the Tahoe Regional Planning Agency and the USDA Forest Service. Each publication describes and inventories a resource or physical feature that is significant to the total environment of the Lake Tahoe Region; it attempts to show the hazards incidental to improperly planned development of the area and to provide information helpful in designing controls that must be implemented if the scenic beauty of the Lake Tahoe Region is to be preserved and its other natural resources are to be conserved. These publications are not exhaustive treatises of their subjects, but they highlight the known significant information and data useful in the planning effort underway. Subjects of publications in this series are:

Climate and Air Quality of the Lake Tahoe Region
Cultural and Historical Significance of the Lake Tahoe Region
Land Resources of the Lake Tahoe Region
Fisheries of Lake Tahoe and Its Tributary Waters
Geology and Geomorphology of the Lake Tahoe Region
Hydrology and Water Resources of the Lake Tahoe Region
Limnology and Water Quality of Lake Tahoe and Tributary Waters
Recreational Resources of the Lake Tahoe Region
Wildlife of the Lake Tahoe Region
Soils of the Lake Tahoe Region
Vegetation of the Lake Tahoe Region
Scenic Analysis of the Lake Tahoe Region

Because of the heavy expense of publication and because these reports are designed chiefly for use by planners, supplies are not available for general public distribution.

APPENDIX E

Table 3 - Distribution of fish by species, and location and area of small lakes and reservoirs in the Lake Tahoe Region

Lake or reservoir	Fish species	Location			Ownership: Surface acres			Ownership: Shoreline miles		
		Sect.	Twp.	Range	N.F.	Pvt.	Total	N.F.	Pvt.	Total
Natural lakes										
Alta Morris	EB, GT	7	12N	17E	5	0	5	0.6	0	0.6
Angora (Lower)	EB	23, 26	12N	17E	10	0	10	.6	0	.6
Angora (Upper)	EB	26	12N	17E	16	0	16	.8	0	.8
Cagwin	EB	34	12N	17E	3	0	3	.3	0	.3
Cascade	RT, BT	27, 28, 33, 34	13N	17E	0	210	210	0	3.5	3.5
Cathedral	EB, GT	10	12N	17E	2	0	2	.2	0	.2
Cliff	EB,GT	18	13N	17E	4	0	4	.5	0	.5
Duck		2	13N	16E	5	3	8	.4	.3	.7
Eagle	RT	29	13N	17E	24	0	24	.8	0	.8
Echo (Upper)	RT, KS	35	12N	17E	75	0	75	2.5	0	2.5
Elbert	EB	30	11N	18E	5	0	5	.6	0	.6
Floating Island	EB	10	12N	17E	2	0	2	.3	0	.3
Fontanillis	EB, BT	1	12N	16E	32	0	32	2.0	0	2.0
Four Lakes #1*		4	10N	18E	1	0	1	.2	0	.2
Four Lakes #2	EB	4, 5	10N	18E	6	0	6	.4	0	.4
Four Lakes #3*		5	10N	18E	4	0	4	.3	0	.3
Four Lakes #4*		5	10N	18E	2	0	2	.2	0	.2
Gefo	EB	31	12N	17E	6	0	6	.6	0	.6
Genevieve	EB, BT	1, 12	13N	16E	8	0	8	.6	0	.6
Granite	EB	28	13N	17E	10	0	10	.6	0	.6
Grass (Luther Pass)	EB	14, 23	11N	18E	13	0	13	.8	0	.8
Grass (Glen Alpine Creek)	EB, KT	20, 21	12N	17E	18	0	18	.7	0	.7
Grouse (Upper)	EB, RT	19	13N	17E	3	0	3	.3	0	.3
Grouse (Lower)	EB	19	13N	17E	2	0	2	.1	0	.1
Half Moon	EB	7	12N	17E	26	0	26	1.5	0	1.5
Jabu	EB, GT	29	12N	17E	3	0	3	.4	0	.4
Kalmia	GT	5	12N	17E	6	0	6	.4	0	.4
LeConte	RT	20	12N	17E	9	0	9	.7	0	.7
Lily	EB	22	12N	17E	5	5	10	.3	.3	.6
Lost (Glen Alpine)	EB	27	12N	17E	4	0	4	.3	0	.3
Lost (General Cr.)	EB, RT	35	14N	16E	0	11	11	0	.9	.9
Lucille	EB	28	12N	17E	11	0	11	.6	0	.6
Margery	EB	28	12N	17E	5	0	5	.5	0	.5
Meiss	EB	4	10N	18E	18	0	18	.7	0	.7
Pyramid	EB, GT	31	12N	17E	15	0	15	1.1	0	1.1

Symbols: *Not stocked by Fish & Game

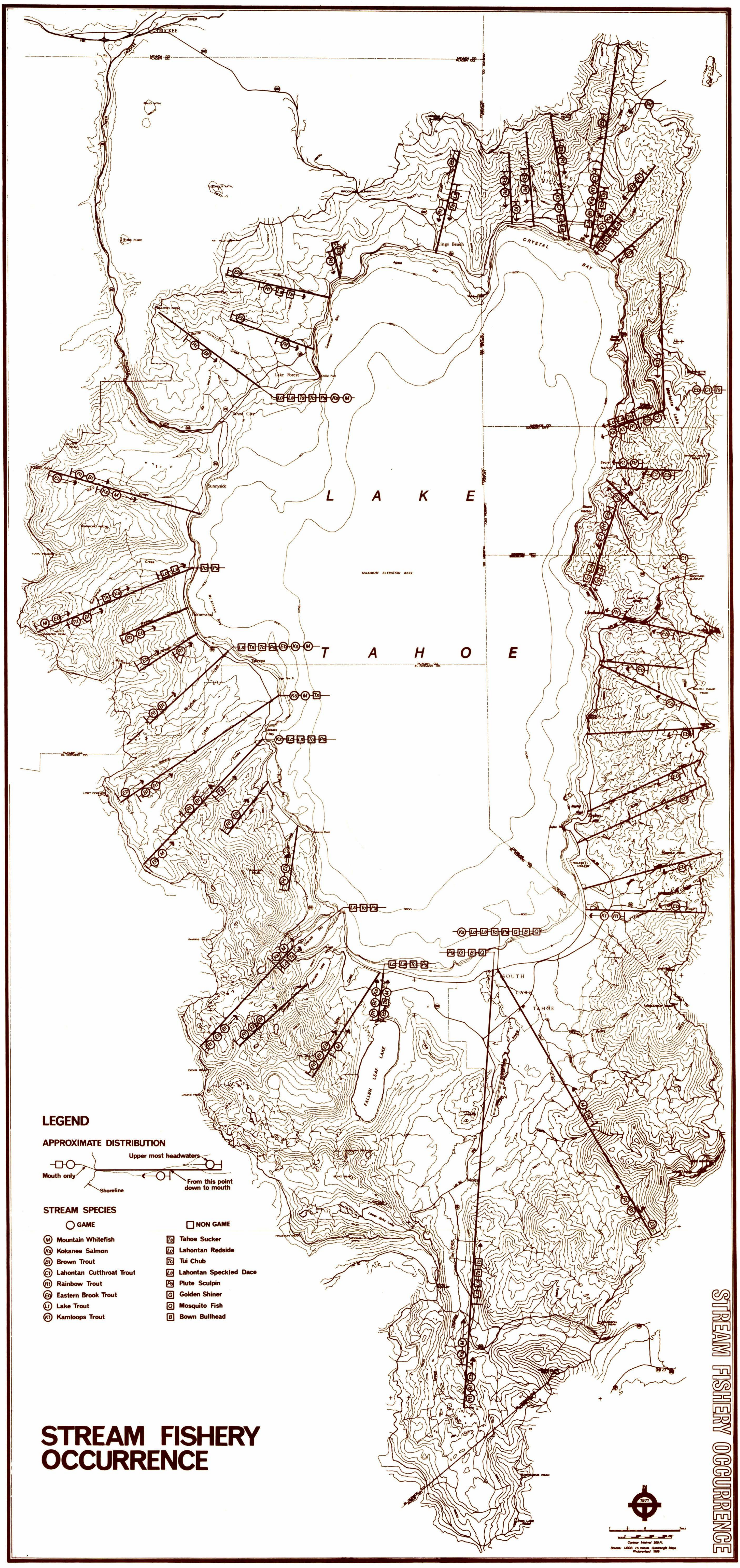
Abbreviations for fish species names: BT, Brown trout; CT, Cutthroat trout; EB, Eastern brook trout; GT, Golden trout; KS, Kokanee salmon; KT, Kamloops trout; LT, Lake trout; RT, Rainbow trout.

Lake or reservoir	Fish species	Location			Ownership					
					Surface acres			Shoreline miles		
		Sect.	Twp.	Range	N.F.	Pvt.	Total	N.F.	Pvt.	Total
Natural lakes										
Ralston	EB, RT	33, 34	12N	17E	15	0	15	.8	0	.8
Richardson	EB	28, 33	14N	16E	5	10	15	.2	.6	.8
Rubicon	EB	18, 19	13N	17E	8	0	8	.8	0	.8
Saucer	EB	2	11N	17E	2	0	2	.2	0	.2
Shadow	EB, BT	7	13N	17E	5	0	5	.6	0	.6
Snow	EB	4, 5	12N	17E	17	0	17	.8	0	.8
Star	EB	30	12N	19E	22	0	22	1.1	0	1.1
Tallac	GT	4	12N	17E	2	0	2	.3	0	.3
Tamarack	EB, RT	33, 34	12N	17E	27	0	27	1.3	0	1.3
Triangle	EB	27	12N	17E	3	0	3	.3	0	.3
Velma (Upper)	EB	31	13N	17E	18	0	18	1.1	0	1.1
Unnamed Lakes		4	10N	18E	3	0	3	.3	0	.3
		5	11N	17E	2	0	2	.3	0	.3
		6	11N	18E	3	1	4	.2	.1	.3
		18	11N	18E	4	0	4	.4	0	.4
		19	11N	18E	2	0	2	.3	0	.3
		20	11N	18E	1	0	1	.2	0	.2
		20	11N	18E	1	0	1	.2	0	.2
		23	11N	18E	1	0	1	.2	0	.2
		23	11N	18E	4	0	4	.4	0	.4
		1	12N	16E	1	0	1	.2	0	.2
		1	12N	16E	2	0	2	.3	0	.3
		1	12N	16E	4	0	4	.5	0	.5
		1	12N	16E	5	0	5	.6	0	.6
		13	12N	16E	1	0	1	.2	0	.2
		7	12N	17E	1	0	1	.2	0	.2
		7	12N	17E	2	0	2	.3	0	.3
		1, 8	12N	17E	1	0	1	.2	0	.2
		8	12N	17E	2	0	2	.3	0	.3
		11	12N	17E	2	0	2	.3	0	.3
		19	12N	17E	1	0	1	.2	0	.2
		20	12N	17E	1	0	1	.2	0	.2
		23	12N	17E	1	0	1	.2	0	.2
		28	12N	17E	1	0	1	.2	0	.2
		29	12N	17E	1	0	1	.2	0	.2
		29	12N	17E	1	0	1	.2	0	.2
		29	12N	17E	3	0	3	.4	0	.4
		29	12N	17E	1	0	1	.2	0	.2
		29	12N	17E	3	0	3	.3	0	.3
	EB#	30	12N	17E	1	0	1	.2	0	.2
		31	12N	17E	1	0	1	.2	0	.2

Symbols: #These species stocked by Fish & Game.

Lake or reservoir	Fish species	Location			Ownership					
					Surface acres			Shoreline miles		
		Sect.	Twp.	Range	N.F.	Pvt.	Total	N.F.	Pvt.	Total
Natural lakes										
Unnamed lakes	EB#	32	12N	17E	5	0	5	.6	0	.6
	RT#	11	13N	16E	2	0	2	.2	0	.2
	RT#	11	13N	16E	1	0	1	.1	0	.1
	EB#	12	13N	16E	4	0	4	.3	0	.3
		12	13N	16E	1	0	1	.1	0	.1
		12	13N	16E	2	0	2	.2	0	.2
		31	13N	17E	7	0	7	.8	0	.8
		31	13N	17E	1	0	1	.2	0	.2
		31	13N	17E	1	0	1	.2	0	.2
		31	13N	17E	1	0	1	.2	0	.2
		33	13N	17E	0	2	2	0	.2	.2
		26, 27	14N	16E	1	1	2	.1	.1	.2
		27	14N	16E	0	2	2	0	.2	.2
		27	14N	16E	0	2	2	0	.2	.2
		28	14N	16E	0	1	1	0	.1	.1
		34	14N	16E	0	10	10	0	.6	.6
		35	14N	16E	1	0	1	.1	0	.1
		29	14N	17E	0	3	3	0	.3	.3
		32	14N	17E	0	2	2	0	.3	.3
		32	14N	17E	0	1	1	0	.1	.1
Artificial lakes										
Azure	EB	5	12N	17E	34	0	34	1.4	0	1.4
Cold Creek Reservoir*		11	12N	18E	0	4	4	0	.7	.7
Crag	EB, BT	12	13N	16E	22	0	22	1.4	0	1.4
Dardanelles	EB	5	10N	18E	18	0	18	1.1	0	1.1
Dicks	KT	6	12N	17E	67	0	67	3.0	0	3.0
Echo (Lower)	RT, KS	1, 2	11N	17E	155	95	250	3.2	.5	3.7
Fallen Leaf	RT, KS	1,2,11,14	12N	17E	500	835	1335	5.6	3.9	9.5
Gilmore	RT	8, 9	12N	17E	78	0	78	1.8	0	1.8
Heather	RT, BT	19	12N	17E	35	0	35	1.7	0	1.7
Hidden	KT, BT, EB	12	13N	16E	7	0	7	.6	0	.6
Round	CT	4	10N	18E	40	0	40	1.4	0	1.4
Showers	EB	5, 6	10N	18E	8	0	8	.6	0	.6
Stoney Ridge	EB, BT, LT	7, 18	13N	17E	60	0	60	1.7	0	1.7
Susie	EB	17	12N	17E	42	0	42	2.0	0	2.0
Velma (Lower)	EB	30, 31	13N	17E	37	0	37	2.0	0	2.0

Lake or reservoir	Fish species	Location			Ownership					
					Surface acres			Shoreline miles		
		Sect.	Twp.	Range	N.F.	Pvt.	Total	N.F.	Pvt.	Total
Insert No. 1: (The data below were obtained from U.S.G.S. 7-1/2 quadrangles and must be checked)										
Natural lakes										
McKinney		23	14N	16E						
Buck		22	14N	16E						
Quail		11, 12	14N	16E						
Lily		22, 27	14N	16E						
Ellis		10, 15	14N	16E						
Unnamed		7	14N	17E						
Unnamed		14	15N	16E						
Unnamed		14	15N	16E						
Unnamed		14	15N	16E						
Unnamed		12	15N	16E						
Watson		19	16N	17E						
Artificial lakes										
Unnamed		6	15N	17E						
Unnamed		25	16N	16E						
Dollar Reservoir		29	16N	17E						



LAKE TAHOE REGION

TAHOE REGIONAL PLANNING AGENCY

USDA FOREST SERVICE